LIMITED INSPECTION REPORT

PREPARED FOR:
Tom Sage
City of Murfreesboro
Parks and Recreation Dept.
697 East Barfield Road
Murfreesboro, TN 37128

SUBJECT:
An Indoor Pool Slide Structure Located @
Patterson Park Community Center
521 Mercury Blvd.
Murfreesboro, TN 37130

OUR FILE NUMBER:
05-12041

PREPARED AND APPROVED BY:

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DATE OF ISSUE: 6/1/12

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Table of Contents

Limited Inspection

Indoor Pool Slide Structure at
Patterson Park Community Center
Murfreesboro, Tennessee

1.0 Introduction and Scope

Mr. Tom Sage, City of Murfreesboro Parks and Recreation Department, retained our firm for the purpose of providing a structural inspection, written report, and plan of repair regarding a steel-frame support structure of an indoor pool slide. Apparent advanced corrosion of steel components and hardware lends to a potential risk of significant injury to users and has prompted this plan of repair. We were not asked to identify a root cause of failure.

We were limited to a visual inspection of the normally visible portions of the structure. We have not employed invasive or destructive inspection procedures, nor were invasive or destructive inspection procedures warranted.

2.0 Executive Summary

It is our understanding that the equipment was placed into service in 2006. Therefore, it is estimated to have been in service for less than five (5) years. A visual inspection of the equipment suggests that a combination of a frequently wet, always humid environment of water treated with chemicals that aggressively attack ferrous metals and the use of metals that possess a significant galvanic potential have resulted in a high rate of corrosion.

Our observations suggest that stainless steel bolts (probably 300 series – anodic index ~ 0.50V) and hot dipped galvanized carbon steel (anodic index ~ 1.20V) were used in the fabrication and construction. Military Standard 889 (Published 1976) indicates that, typically for a harsh environment, metals exhibiting less than 0.15V difference in anodic index should be used to minimize the galvanic corrosion potential. It is possible that up to a difference of 0.70V exists in the metals that were used.

The most severe corrosion appears to have developed on the base plates and anchor bolts. Even though, based on appearances, these appear to have sustained the worst damage they do not present an imminent risk of catastrophic failure.

Hot dipped galvanized structural steel is often used in this type application because the molten zinc can flow into, and protect, the interior surfaces of hollow structural shapes, such as round columns and square tube. These are surfaces that a spray applied coating, such as paint, cannot reach. Therefore, it is troubling to find corrosion so well developed on a horizontal brace as illustrated in photo 3. This presentation could suggest that water draining into the hollow interior may be causing this component to rust through from the inside. Sudden failure of this component could present a risk of significant injury to users. Although we see no evidence of imminent catastrophic failure, at the current rate of corrosion (< five years of service) we expect that this component would be the first to fail.

3.0 General Notes

Robert D. Warren, P.E., President, Warren Engineering Inc. prepared this report from the information gathered. Scott Warren E.I., assisted the writer, gathered field notes, and photographically documented the condition of the structure.

Visit Date(s)

Two visits were made; the first visit was a cursory site inspection that occurred on March 17, 2011 for the purposes of providing a proposal contract for our services. Our second inspection was performed on May 29, 2012 and occurred in the morning. No additional visits were made prior to the issuance of this report.

Subject Description

The subject structure supports a pre-fabricated fiberglass pool kit that was assembled on site. The steel-structure frame features round hollow-structural-steel (HSS) columns. Horizontal square HSS members function as cantilevered arms to support the slide at its flanged joint sections. The “arm” is a two piece section with a larger square HSS section that is fastened with heavy-hex head bolts to a an MC-shape steel bracket that is welded directly to the round HSS column. The smaller square HSS section is situated in the cavity of the larger square HSS section and is cantilevered; a metal gusset plates is welded to the cantilevered-end of the beams and receive structural heavy-hex headed bolts that through-fasten the fiberglass slide. The cantilevered arms are located at various elevations and degrees from each other.

The base of the steel columns are welded to 1-inch thick steel base plates that feature four (4) anchor bolts. The entire structure is anchored to the perimeter pool concrete slab-on-grade (SOG).

Observation Criteria

The following pages provide photo documentation gathered during our second visit. For the purposes of orientation referenced in the photo comments, we will define the various faces of the structure as Project North, South, East, and West with those directions identified by the Key Plan (Sheet 1) of the attached Plan of Repair.

4.0 Photo Documentation

Photo 1: North Face

Photo 2: East Face

4.0 Photo Documentation cont...

Photo 3: West Face

Photo 4: North-west Face

4.0 Photo Documentation cont...

Photo 5: Anchor plate E. Corroded bolt nut grinded away to flush with plate. Corrosion exhibited by horizontal square HSS members.

Photo 6: Anchor plate A. Corrosion exhibited by base plate and anchors and nuts. Grout pad is fractured.

4.0 Photo Documentation cont...

Photo 7: Anchor plate A. Corroded bolt and nut.

Photo 8: One-inch thick base plate.

4.0 Photo Documentation

Photo 9: Top of column

Photo10: Horizontal arm exhibiting corrosion @ column E. Note the corrosion exhibited by the through-bolts that fasten the flanged joints of the adjoining fiberglass slide sections.

4.0 Photo Documentation

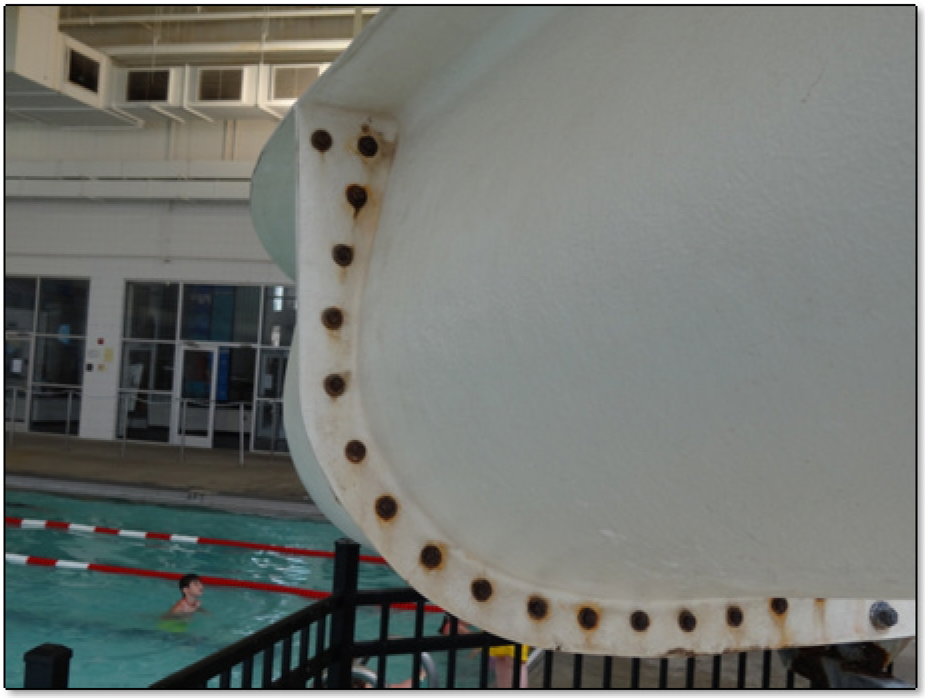


Photo 11: Facing project east

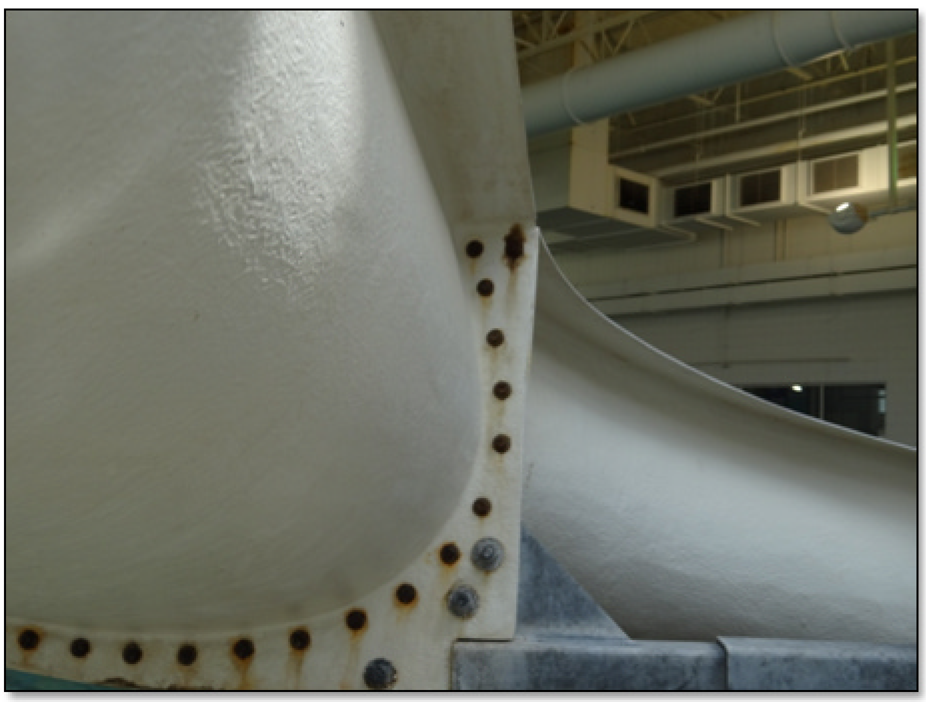


Photo 12: Same as above. Note the corrosion of through-bolts at flanged joint.

4.0 Photo Documentation

Photo 13: Stainless steel through-bolt fastens fiberglass slide sections together at flanged joint.

Photo 14: Corrosion exhibited by MC-shape gusset plate and bolt group. Note the corrosion exhibited by the weld to the left end of this photo.

5.0 Observations Summary

The following describes the observations made during this inspection:

- The slide features a pump that provides a waterfall effect down the chute of the slide.
- The interior conditions are hot, humid, and wet with nominal to no ventilation.
- Splash-water that escapes the inside of the slide chute and pool continually wets the structural members.
- No part of the structure is complete submerged.
- The surrounding concrete slab slopes to drain towards the pool.
- The concrete slab bears directly on grade, likely a crushed stone subgrade base.
- No members or connections exhibit failure in general yielding or rupture, however almost complete degradation of projected anchor rods above plates is present in many locations, namely at columns “A” and “E”, was observed. **(photos 5 & 7)**
- It is estimated that every structural member of the pool-slide structure and most joints (including the bolt group, washers, & nuts) and bearing plates exhibit some level of corrosion.
- The structural members (columns, baseplates and cantilevered arm beams) appear to be hot-dipped galvanized carbon-steel members as evidenced by the textured zinc-rich coating
- The anchor bolts at the base plates and through-bolts at slide sections appear to be stainless steel (as opposed to typical carbon steel alloy). **(photo 13)**
- A portion of a weld where a cantilevered arm is fixed at a column exhibits corrosion along the upper portions of the weld, where tension is greatest. **(photo 14)**
- We did not observe leaks through separations of slide sections.
- Corrosion has stained the surrounding concrete slab. **(photos 5 & 7)**
- Reduction in cross-sectional area is exhibited by many members and plates. **(photo 9)**

6.0 Corrosion Mechanisms in Stainless Steel (British Stainless Steel Association)

Stainless steels are generally very corrosion resistant and will perform satisfactorily in most environments. The limit of corrosion resistance of a given stainless steel depends on its constituent elements which mean that each grade has a slightly different response when exposed to a corrosive environment. Care is therefore needed to select the most appropriate grade of stainless steel for a given application. As well as careful material grade selection, good detailing and workmanship can significantly reduce the likelihood of staining and corrosion.

Pitting corrosion
Pitting is a localized form of corrosion which can occur as a result of exposure to specific environments, most notably those containing chlorides. In most structural applications, the extent of pitting is likely to be superficial and the reduction in section of a component is negligible. However, corrosion products can stain architectural features. A less tolerant view of pitting should be adopted for services such as ducts, piping and containment structures. If there is a known pitting hazard, then a molybdenum bearing stainless steel will be required.

Crevice corrosion
Crevice corrosion is a localized form of attack which is initiated by the extremely low availability of oxygen in a crevice. It is only likely to be a problem in stagnant solutions where a build-up of chlorides can occur. The severity of crevice corrosion is very dependent on the geometry of the crevice; the narrower (around 25 micro-metres) and deeper the crevice, the more severe the corrosion. Crevices typically occur between nuts and washers or around the thread of a screw or the shank of a bolt. Crevices can also occur in welds which fail to penetrate and under deposits on the steel surface.

Bimetallic (galvanic) corrosion
Bimetallic (galvanic) corrosion may occur when dissimilar metals are in contact in a common electrolyte (e.g. rain, condensation etc.). If current flows between the two, the less noble metal (the anode) corrodes at a faster rate than would have occurred if the metals were not in contact.

The rate of corrosion also depends on the relative areas of the metals in contact, the temperature and the composition of the electrolyte. In particular, the larger the area of the cathode in relation to that of the anode, the greater the rate of attack. Adverse area ratios are likely to occur with fasteners and at joints. Carbon steel bolts in stainless steel members should be avoided because the ratio of the area of the stainless steel to the carbon steel is large and the bolts will be subject to aggressive attack. Conversely, the rate of attack of a carbon steel member by a stainless steel bolt is much slower. It is usually helpful to draw on previous experience in similar sites because dissimilar metals can often be safely coupled under conditions of occasional condensation or dampness with no adverse effects, especially when the conductivity of the electrolyte is low.

The prediction of these effects is difficult because the corrosion rate is determined by a number of complex issues. The use of potential tables ignores the presence of surface oxide films and the effects of area ratios and different solution (electrolyte) chemistry. Therefore, uninformed use of these tables may produce erroneous results. They should be used with care and only for initial assessment.

Austenitic stainless steels usually form the cathode in a bimetallic couple and therefore do not suffer corrosion. Contact between austenitic stainless steels and zinc or aluminum may result in some additional corrosion of the latter two metals. This is unlikely to be significant structurally, but the resulting white/grey powder may be deemed unsightly. Bimetallic corrosion may be prevented by excluding water from the detail (e.g. by painting or taping over the assembled joint) or isolating the metals from each other (e.g. by painting the contact surfaces of the dissimilar metals). Isolation around bolted connections can be achieved by non-conductive plastic or rubber gaskets and nylon or teflon washers and bushes. This system is a time consuming detail to make on site and it is not possible to provide the necessary level of site inspection to check that all the washers and sleeves have been installed properly.

The general behavior of metals in bimetallic contact in rural, urban, industrial and coastal environments is fully documented in PD 6484 'Commentary on corrosion at bimetallic contacts and its alleviation'.

Stress corrosion cracking (SCC)

The development of stress corrosion cracking (SCC) requires the simultaneous presence of tensile stresses and specific environmental factors. It is uncommon in normal building atmospheres. The stresses do not need to be very high in relation to the proof stress of the material and may be due to loading and/or residual effects from manufacturing processes such as welding or bending. Caution should be exercised when stainless steel members containing high residual stresses (e.g. due to cold working) are used in chloride rich environments (e.g. swimming pools enclosures, marine, offshore).

General (uniform) corrosion

General corrosion is much less severe in stainless steel than in other steels. It only occurs when the stainless steel is at a pH value < 1.0. Reference should be made to tables in manufacturers' literature, or the advice of a corrosion engineer should be sought, if the stainless steel is to come into contact with chemicals.

Intergranular attack and weld decay

When austenitic stainless steels are subject to prolonged heating between 450-850^0 C, the carbon in the steel diffuses to the grain boundaries and precipitates chromium carbide. This removes chromium fromthe solid solution and leaves a lower chromium content adjacent to the grain boundaries. Steels in this condition are termed 'sensitised'. The grain boundaries become prone to preferential attack on subsequent exposure to a corrosive environment. This phenomenon is known as weld decay when it occurs in the heat affected zone of a weldment.
Grades of stainless steel which have a low carbon content (~0.03%) will not become sensitised, even for plate thicknesses up to 20 mm when welded by arc processes (giving rapid heating and cooling). Furthermore, modern steelmaking processes mean that a carbon content of 0.05% or less is generally achieved in the standard carbon grades 304 and 316, so these grades will not be prone to weld decay when welded by arc processes.

7.0 Conclusions and Recommendations

Conclusions
In general, progressive degradation of structural material can lead to unexpected failure modes, possibly with little warning, leading to injury of pool-slide users. As stated in Section 6.0, stainless steel bolts in contact with carbon steel structural members can corrode, although at a slower rate when compared to stainless steel members and carbon-steel bolts. In the presence of electrolytic medium such as salt-water or chlorinated water, a galvanic cell is introduced facilitating the redox reaction that is common in the cell of a battery in which electric current is introduced. This electric current is possible because of dissimilar metals. For this reaction to occur material of one metal is sacrificed. Like batteries, the sacrificial anode (in this case the carbon steel) is eventually corroded all potential is lost.

Unfortunately, for structures in an environment of chlorinated water in tandem with hot, humid conditions, corrosion is inevitable especially in the when dissimilar metals are joined as we observed with this structure. The warmer the environment, the greater the electrolytic potential. Chlorinated pools and salt-treated pools alike present a medium conducive for galvanic corrosion.

Recommendations
We see no immediate concern for structural failure; therefore we are not recommending replacement of structural members; however, the level of deterioration exhibited by the anchor bolts and base plates of the five (5) columns when considering the dynamic loading experienced by the structure warrants supplementation. We make no claim as to the health-safety hazards presented by the corrosion suspended in the splash-water adjacent the slide and near the pool.

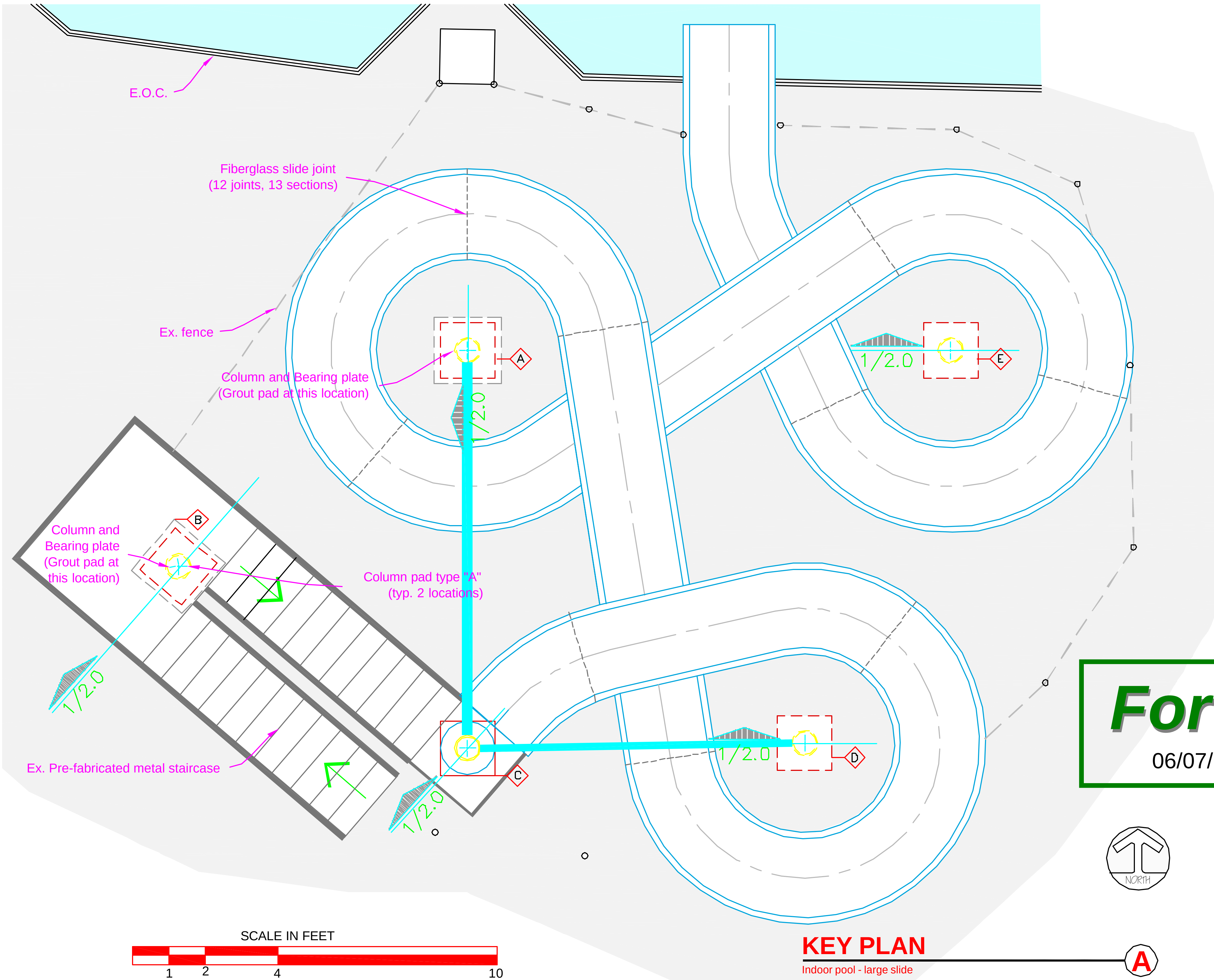
The following outlines the procedure and plan for extending the service life of the slide structure for approximately 5-7 years at which point a re-inspection of performance would be advocated. The access staircase is specifically excluded from the following remedial procedure; based on apparent performance remediation is not necessary.

1. Isolate the slide structure around the perimeter with minimum 6-mil plastic.
2. Sand-blast all faces of exposed structural members of the slide.
3. Protect runoff from entering the pool
4. Remove and replace all through-bolts at each slide-section (12 sections, 11 joints) joints with min. 6% Molybdenum super-austenitic stainless steel with same diameter and nuts/washers.
5. Coat all cleaned faces of structural members, plates, & existing hardware with Sherwin-Williams ® Zinc Clad ® II Ethyl Silicate Inorganic zinc-rich primer coating and topcoat system (see material spec sheet)
6. Install supplemental channel hold-down-plate (MC 4x13.8, flange thickness ½-inch) across top of existing five (5) anchor plates. Pre-drilled holes in supplemental hold-down-plate shall receive a 5/8-inch diameter all-thread bolt (F1554 A36 steel, galvanized). A563 Grade A nuts shall be placed on the underside and topside of the MC-channel shape with ASTM F844 standard flat washers in between.
7. Drill ¾-inch diameter into concrete slab to receive anchor rod.
8. Set in Simpson ® Set-Xp ® epoxy after properly preparing hole.
9. Columns "A" and "B" feature a solid grout-pad underneath the anchor base plate due to the slope of the slab. Remove and replace the fractured portions with non-shrink grout.

See attached Plans and Specifications for Details.

8.0 Limitations

Destructive or invasive inspection procedures were neither warranted nor employed. We were limited to those surfaces that are normally visible with the unaided eye. This evaluation is based on a Distress Inventory. This report should not be confused with a comprehensive structural analysis of capacity or performance. Any item not specifically mentioned in this report is specifically excluded. The opinions and comments contained in this report are based on the observation of apparent performance of the structure and the qualified knowledge and experience of this office. Compliance with any specifications, except as expressly noted, legal, or code requirements, is specifically excluded from this report. No guarantee or warranty as to future life or performance of any item inspected is intended. Partial reproduction of this report is prohibited.



KEY PLAN A

Indoor pool - large slide

GENERAL NOTES:

Some items have been omitted for clarity such as the cantilevered support arms fastened to each column section.

The structure is generally described as a steel frame featured round HSS columns, square HSS arms bolted to MC-shape brackets that are welded to each column at various locations. Square HSS-sections span between columns at various elevations to provide lateral stability.

REMEDIATION NOTES:

Generally, this remediation plan will involve sand-blasting base-plates and select locations on column arms where excessive corrosion is observed and replacing/supplementing structural elements to the pool slide.

Sheet 2.0 provides detail drawings identifying the procedure and specifications for remediation. This scope includes sand-blasting, cleaning, application of zinc-rich primer and topcoat of ALL surfaces of slide structure AND hardware, installation of supplemental anchor shoe-plates and bolts at each five (5) column pad locations. Additionally, two typical locations feature a grout-base pad that shall be removed and replaced with non-shrink grout.

For Review

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PATTERSON PARK POOL STRUCTURAL REMEDIATION - INDOOR POOL SLIDE

Murfreesboro, Tennessee

Sheet 1.0

Composite As-built

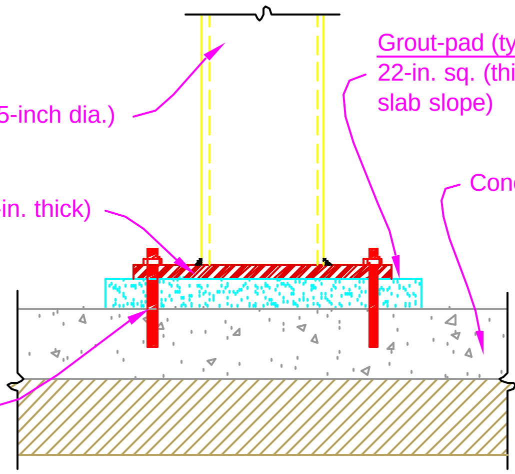
Column: Round HSS (8.625-inch dia.)

Grout-pad (typ. 2 locations): 22-in. sq. (thickness varies with slab slope)

Baseplate: 18-in. sq. (1-in. thick)

Conc. slab-on-grade

Anchor Bolts: 5/8-in. dia. with nut (4 per pad)



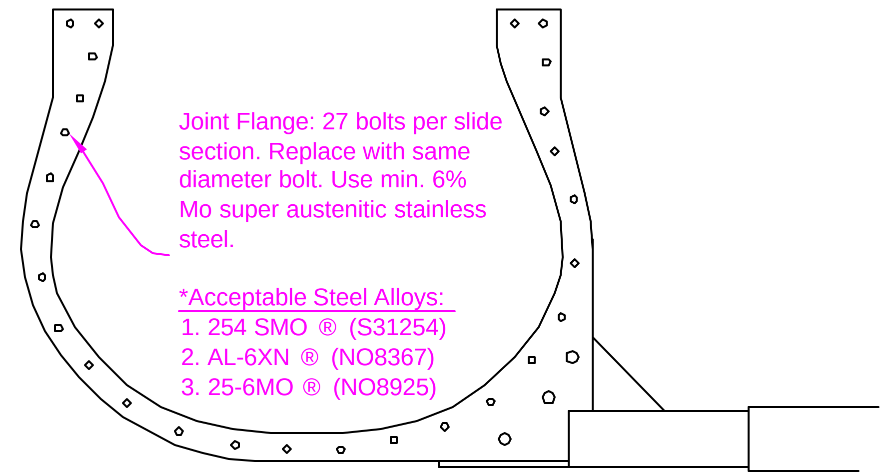
EXISTING SECTION 1

Column Bearing (typ. 5 locations)

Joint Flange: 27 bolts per slide section. Replace with same diameter bolt. Use min. 6% Mo super austenitic stainless steel.

*Acceptable Steel Alloys:

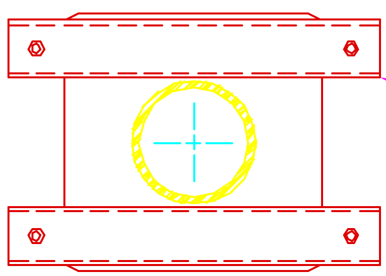
1. 254 SMO ® (S31254)
2. AL-6XN ® (NO8367)
3. 25-6MO ® (NO8925)



SECTION 2

Slide joint detail

Apply zinc-rich primer and topcoat to all faces of baseplate and supplemental shoe-plates and new anchors (including hardware). See material pec sheet.



Supplemental Channel hold-down-plates extend past existing bearing plate

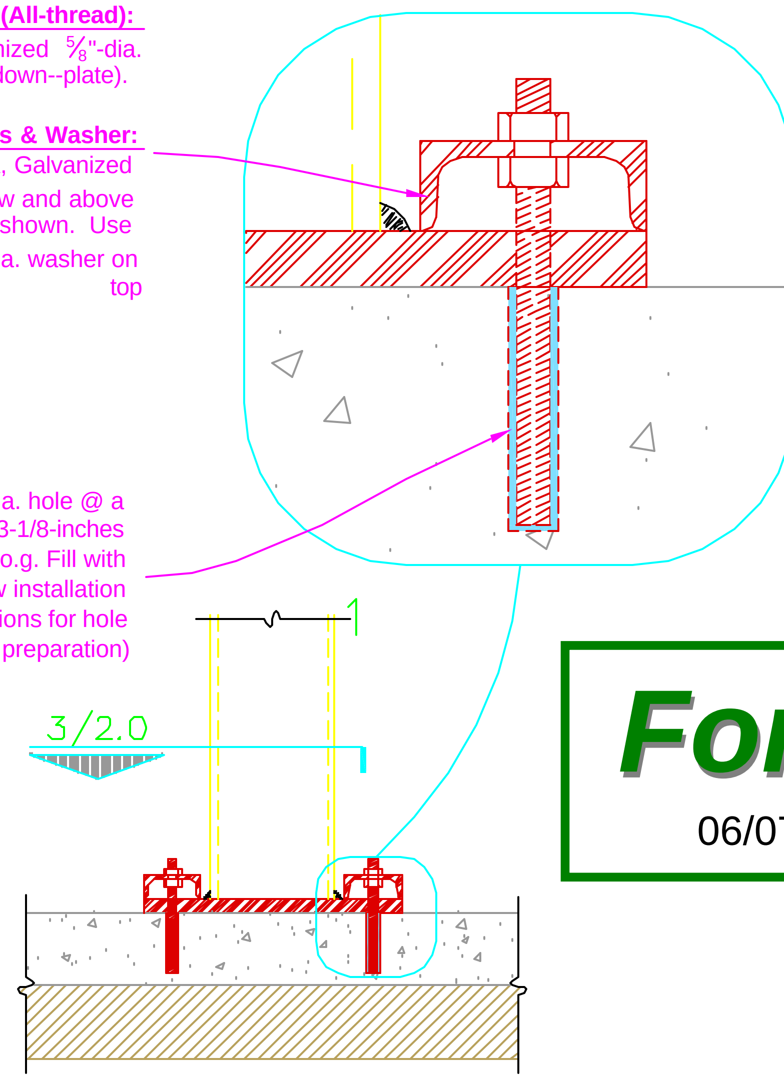
NEW PLAN-SECTION 3

Column Bearing (typ. 5 locations)

Anchor Bolt (All-thread):
ASTM F1554 A36, Galvanized 5/8"-dia. bolt (2 locations per hold-down--plate).

Nuts & Washer:
Two (2) A563 Grade A, Galvanized 5/8"-dia. hex nuts - one below and above flange of channel section as shown. Use ASTM F844 standard 5/8"-dia. washer on top

Drill 3/4-inch dia. hole @ a min. depth of 3-1/8-inches into pool conc. s.o.g. Fill with epoxy. (Follow installation instructions for hole preparation)

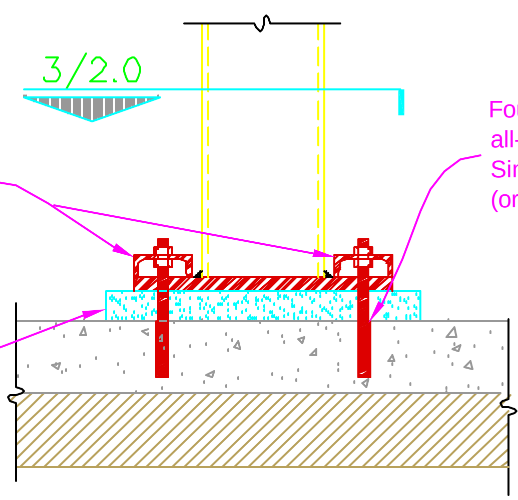


*Remediation for Type "B" base plates are similar to Type "A"

Supplemental Hold-Down-Plate:
MC-channel section (MC 4x4.5) along two sides.

Four (4) NEW 5/8-inch dia. all-thread rod set in Simpson ® Set-XP epoxy (or approved equal).

R&R fractured grout pad with non-shrink grout to maintain continuous bearing under baseplate



NEW SECTION 4

Bearing Plate Anchor Supplementation (typ. 5 locations)

NEW SECTION 5

Bearing Plate Anchor Supplementation (typ. 5 locations)

GENERAL NOTES:

Some items have been omitted for clarity such as the cantilevered support arms fastened to each column section.

The structure is generally described as a steel frame featured round HSS columns, square HSS arms bolted to MC-shape brackets that are welded to each column at various locations. Square HSS-sections span between columns at various elevations to provide lateral stability.

REMEDIATION NOTES:

Generally, this remediation plan will involve sand-blasting base-plates and select locations on column arms where excessive corrosion is observed and replacing/supplementing structural elements to the pool slide.

Sheet 2.0 provides detail drawings identifying the procedure and specifications for remediation. This scope includes sand-blasting, cleaning, application of zinc-rich primer and topcoat, and installation of supplemental anchor shoe-plates and bolts at each five (5) column pad locations. Additionally, two typical locations feature a grout-base pad that shall be removed and replaced with non-shrink grout.

For Review

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PATTERSON PARK COMMUNITY CENTER
INDOOR POOL SLIDE REMEDIATION
Murfreesboro, Tennessee

Sheet 2.0
Section Details

Protective & Marine Coatings

ZINC CLAD® II ETHYL SILICATE
INORGANIC ZINC-RICH COATING

PART E	B69V3	BINDER
PART F	B69D11	ZINC DUST

Revised 2/12

PRODUCT INFORMATION

6.02

PRODUCT DESCRIPTION

ZINC CLAD II ETHYL SILICATE is a solvent-based two-package, inorganic ethyl silicate, zinc-rich coating.

- Meets Class B requirements for Slip Coefficient and Creep Resistance, .56
- Meets AASHTO M-300 specification
- 85% zinc content in dry film
- Coating self-heals to resume protection if damaged
- Provides cathodic/sacrificial protection by the same mechanism as galvanizing. Also protects steel by forming an inorganic moisture and solvent barrier

PRODUCT CHARACTERISTICS

Finish:	Flat
Color:	Gray-green
Volume Solids:	62% ± 2%, ASTM D2697, mixed
Weight Solids:	82% ± 2 %, mixed
VOC (calculated): mixed	Unreduced: <500 g/L; 4.17 lb/gal Reduced 10%: <500 g/L; 4.17 lb/gal
Zinc Content in Dry Film:	85% by weight
Mix Ratio:	2 components; premeasured 5 gallons (18.9L) mix

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	**3.5** (88)	**6.5** (163)
Dry mils (microns)	**2.0** (50)	**4.0** (100)
~Coverage sq ft/gal (m^2/L)	**248** (6.1)	**496** (12.2)
Theoretical coverage **sq ft/gal** (m^2/L) @ 1 mil / 25 microns dft	**995** (24.3)	

Dry film thickness in excess of 6.0 mils (150 microns) per coat is not recommended.

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 5.0 mils wet (125 microns):

	@ 55°F/13°C	@ 77°F/25°C *50% RH*	@ 100°F/38°C
Rain resistant:	1 hour	20-30 minutes	15 minutes
To touch:	30 minutes	15 minutes	5 minutes
To handle:	3 hours	1-2 hours	20 minutes
To recoat:	48 hours	18 hours	18 hours
To cure:	7 days	7 days	7 days
Immersion service:	14 days	14 days	14 days

Drying time is temperature, humidity, and film thickness dependent.

Pot Life:	18 hours	8 hours	6 hours

Note: High humidity will shorten the pot life.

Sweat-in-Time: None required

Shelf Life:	Part E: 9 months, unopened Part F: 24 months, unopened Store indoors at 40°F (4.5°C) to 100°F (38°C).
Flash Point:	55°F (13°C), PMCC, mixed
Reducer/Clean Up:	
Below 80°F (27°C):	Xylene, R2K4
Above 80°F (27°C):	Reducer #58, R7K58 or Reducer 100, R2K5

RECOMMENDED USES

For use over properly prepared blasted steel.
- As a one-coat maintenance coating or as a permanent primer for severely corrosive environments (pH range 5-9)
- Economical replacement for galvanizing with similar performance
- Ideal for application at low temperatures or service at high temperatures and/or humidity conditions
- Water intake and discharge lines (non-potable)
- Where abrasion resistance and hardness is required
- Bridges, refineries, drilling rigs
- Shop or field application
- Not recommended for severe acid or alkali exposure
- This product meets specific design requirements for non-safety related nuclear plant applications in Level II, III and Balance of Plant, and DOE nuclear facilities*.
- Nuclear Power Plants
- Nuclear fabrication shops
- DOE Nuclear Fuel Facilities
- DOE Nuclear Weapons Facilities

* Nuclear qualifications are NRC license specific to the facility.

PERFORMANCE CHARACTERISTICS

Substrate*: Steel

Surface Preparation*: SSPC-SP10/NACE 2

System Tested*:

1 ct. Zinc Clad II @ 3.0 mils dft (75 microns)

*unless otherwise noted below

Test Name	Test Method	Results
Abrasion Resistance	ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load	326 mg loss
Adhesion	ASTM D4541	6.77 MPa = 982 lb psi
Direct Impact Resistance	ASTM D2794	60 in. lbs.
Dry Heat Resistance	ASTM D2485	750°F (399°C)
Immersion Resistance (untopcoated)	1 year	Acceptable for: crude oil, fresh and demineralized water, gasoline
Moisture Condensation Resistance	ASTM D4585, 100°F (38°C), 2000 hours	No Failure
Pencil Hardness	ASTM D3363	3H
Radiation Tolerance	ASTM D4082 / ANSI 5.12	Pass at 5 mils (125 microns)
Salt Fog Resistance	ASTM B117, 2000 hours	No Failure
Slip Coefficient* (zinc only)	AISC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts	Class B, 0.56
Wet Heat Resistance	Non-immersion	115°F (46°C)

Provides performance comparable to products formulated to Federal Specifications: Mil-P-38336, Mil-P-46105, and SSPC Paint 20.

*Refer to Slip Certification document

continued on back

Protective & Marine Coatings

ZINC CLAD® II ETHYL SILICATE
INORGANIC ZINC-RICH COATING

PART E	B69V3	BINDER
PART F	B69D11	ZINC DUST

PRODUCT INFORMATION

6.02

RECOMMENDED SYSTEMS

		Dry Film Thickness / ct. Mils	(Microns)
Steel, Zinc Primer/Finish, immersion or atmospheric:			
1 ct.	Zinc Clad II Ethyl Silicate	2.0-4.0	(50-100)
Steel, Acrylic Topcoat, atmospheric:			
1 ct.	Zinc Clad II Ethyl Silicate	2.0-4.0	(50-100)
2 cts.	DTM Acrylic Coating	2.5-4.0	(63-100)
Steel, Coal Tar Epoxy Topcoat, atmospheric:			
1 ct.	Zinc Clad II Ethyl Silicate	2.0-4.0	(50-100)
1 ct.	Hi-Mil Sher-Tar Epoxy	16.0-20.0	(400-500)
Steel, Epoxy Topcoat, atmospheric:			
1 ct.	Zinc Clad II Ethyl Silicate	2.0-4.0	(50-100)
1-2 cts.	Macropoxy HS	3.0-6.0	(75-150)
Steel, Epoxy Topcoat, atmospheric:			
1 ct.	Zinc Clad II Ethyl Silicate	2.0-4.0	(50-100)
2 cts.	Tile-Clad HS Epoxy	3.0-4.0	(75-100)
Steel, Urethane Topcoat, atmospheric:			
1 ct.	Zinc Clad II Ethyl Silicate	2.0-4.0	(50-100)
1 ct.	Macropoxy HS	3.0-6.0	(75-150)
1 ct.	Sherthane 2K Urethane	2.0-4.0	(50-100)

NOTE: 1 ct. of DTM Wash Primer or Pro-Cryl Universal Primer can be used as an intermediate coat under recommended topcoats to prevent pinholing.

Steel, Class B Compliant System			
1 ct.	Zinc Clad II Ethyl Silicate	2.0-4.0	(50-100)
1 ct.	Steel Spec Epoxy Primer (red)	4.0-6.0	(100-150)
or			
1 ct.	Zinc Clad II Ethyl Silicate	2.0-4.0	(50-100)

The systems listed above are representative of the product's use, other systems may be appropriate.

DISCLAIMER

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SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:
Iron & Steel
Atmospheric: SSPC-SP6/ NACE 3, 2 mil (50 micron) profile
Immersion: SSPC-SP10/NACE 2, 2 mil (50 micron) profile

Surface Preparation Standards

	Condition of Surface	ISO 8501-1 BS7079:A1	Swedish Std. SIS055900	SSPC	NACE
White Metal		Sa 3	Sa 3	SP 5	1
Near White Metal		Sa 2.5	Sa 2.5	SP 10	2
Commercial Blast		Sa 2	Sa 2	SP 6	3
Brush-Off Blast		Sa 1	Sa 1	SP 7	4
Hand Tool Cleaning	Rusted	C St 2	C St 2	SP 2	-
	Pitted & Rusted	D St 2	D St 2	SP 2	-
Power Tool Cleaning	Rusted	C St 3	C St 3	SP 3	-
	Pitted & Rusted	D St 3	D St 3	SP 3	-

TINTING

Do not tint.

APPLICATION CONDITIONS

Temperature:	
air and surface:	0°F (-7°C) minimum, 120°F (49°C) maximum
material:	40°F (4.5°C) minimum
	At least 5°F (2.8°C) above dew point
Relative humidity:	40% - 90% maximum
	Water misting may be required at humidities below 50%

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging:	5 gallons (18.9L) mixed
Part E:	3.75 gallons (14.2L) in a 5 gallon (18.9L) can
Part F:	73 lb (33.1 Kg) zinc dust
Weight:	20.9 ± 0.2 lb/gal ; 2.5 Kg/L, mixed

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

WARRANTY

The Sherwin-Williams Company warrants our products to be free of manufacturing defects in accord with applicable Sherwin-Williams quality control procedures. Liability for products proven defective, if any, is limited to replacement of the defective product or the refund of the purchase price paid for the defective product as determined by Sherwin-Williams. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY SHERWIN-WILLIAMS, EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Protective & Marine Coatings ZINC CLAD® II ETHYL SILICATE

INORGANIC ZINC-RICH COATING

Part E	B69V3	Binder
Part F	B69D11	Zinc Dust

Revised 2/12

Application Bulletin

Surface Preparations

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Zinc rich coatings require direct contact between the zinc pigment in the coating and the metal substrate for optimum performance.

Iron & Steel (atmospheric service)
Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Commercial Blast Cleaning per SSPC-SP6/NACE 3. For better performance, use Near White Metal Blast Cleaning per SSPC-SP10/NACE 2. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils / 50 microns). Prime any bare steel the same day as it is cleaned or before flash rusting occurs.

Iron & Steel (immersion service)
Remove all oil and grease from surface by Solvent Cleaning per SSPC-SP1. Minimum surface preparation is Near White Metal Blast Cleaning per SSPC-SP10/NACE 2. Blast clean all surfaces using a sharp, angular abrasive for optimum surface profile (2 mils / 50 microns). Remove all weld spatter and round all sharp edges by grinding. Prime any bare steel the same day as it is cleaned or before flash rusting occurs.

Note: If blast cleaning with steel media is used, an appropriate amount of steel grit blast media may be incorporated into the work mix to render a dense, angular 1.5-2.0 mil (38-50 micron) surface profile. This method may result in improved adhesion and performance.

Surface Preparation Standards

	Condition of Surface	ISO 8501-1 BS7079:A1	Swedish Std. SIS055900	SSPC	NACE
White Metal		Sa 3	Sa 3	SP 5	1
Near White Metal		Sa 2.5	Sa 2.5	SP 10	2
Commercial Blast		Sa 2	Sa 2	SP 6	3
Brush-Off Blast		Sa 1	Sa 1	SP 7	4
Hand Tool Cleaning	Rusted	C St 2	C St 2	SP 2	-
	Pitted & Rusted	D St 2	D St 2	SP 2	-
Power Tool Cleaning	Rusted	C St 3	C St 3	SP 3	-
	Pitted & Rusted	D St 3	D St 3	SP 3	-

Application Conditions

Temperature:
- air and surface: 0°F (-7°C) minimum, 120°F (49°C) maximum
- material: 40°F (4.5°C) minimum
  At least 5°F (2.8°C) above dew point

Relative humidity: 40% - 90% maximum
Water misting may be required at humidities below 50%

Application Equipment

The following is a guide. Changes in pressures and tip sizes may be needed for proper spray characteristics. Always purge spray equipment before use with listed reducer. Any reduction must be compliant with existing VOC regulations and compatible with the existing environmental and application conditions.

Reducer/Clean Up
Below 80°F (27°C).........Xylene, R2K4
Above 80°F (27°C).........Reducer #58, R7K58 or Reducer 100, R2K5

Airless Spray
(use Teflon packings and continuous agitation)
Pressure.........................1800 - 2000 psi
Hose...............................3/8" ID
Tip..................................017" - .021"
Reduction.......................As needed up to 10% by volume

Conventional Spray
(continuous agitation required)
Gun ....Binks 95
Fluid Nozzle 66
Air Nozzle.......................63PB
Atomization Pressure.....30 - 40 psi
Fluid Pressure................10 - 20 psi
Reduction.......................As needed up to 10% by volume

Keep pressure pot at level of applicator to avoid blocking of fluid line due to weight of material. Blow back coating in fluid line at intermittent shutdowns, but continue agitation at pressure pot.

Brush ....For touch-up only

If specific application equipment is not listed above, equivalent equipment may be substituted.

continued on back

Protective & Marine Coatings

ZINC CLAD® II ETHYL SILICATE
INORGANIC ZINC-RICH COATING

PART E	B69V3	BINDER
PART F	B69D11	ZINC DUST

APPLICATION BULLETIN

6.02

APPLICATION PROCEDURES

Surface preparation must be completed as indicated.

Zinc Clad II comes in 2 premeasured containers which when mixed provides 5 gallons (18.9L) of read-to-apply material.

Mixing Instructions: Thoroughly agitate Binder Part E using low speed continuous air driven agitation. Slowly mix all of Zinc Dust Part F into all of Binder Part E until mixture is completely uniform. After mixing, pour mixture through 30-60 mesh screen. Mixed material must be used within 8 hours. Do not mix previously mixed material with new.
If reducer solvent is used, add only after both components have been thoroughly mixed.
Continuous agitation of mixture during application is required, otherwise zinc dust will quickly settle out.

Apply paint at the recommended film thickness and spreading rate as indicated below:

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	**3.5** (88)	**6.5** (163)
Dry mils (microns)	**2.0** (50)	**4.0** (100)
~Coverage sq ft/gal (m^2/L)	**248** (6.1)	**496** (12.2)
Theoretical coverage **sq ft/gal** (m^2/L) @ 1 mil / 25 microns dft	**995** (24.3)	

Dry film thickness in excess of 6.0 mils (150 microns) per coat is not recommended.

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 5.0 mils wet (125 microns):

	@ 55°F/13°C	@ 77°F/25°C *50% RH*	@ 100°F/38°C
Rain resistant:	1 hour	20-30 minutes	15 minutes
To touch:	30 minutes	15 minutes	5 minutes
To handle:	3 hours	1-2 hours	20 minutes
To recoat:	48 hours	18 hours	18 hours
To cure:	7 days	7 days	7 days
Immersion service:	14 days	14 days	14 days

Drying time is temperature, humidity, and film thickness dependent.

Pot Life:	18 hours	8 hours	6 hours

Note: High humidity will shorten the pot life.

Sweat-in-Time: None required

Application of coating above maximum or below minimum recommended spreading rate may adversely affect coating performance.

CLEAN UP INSTRUCTIONS

Clean spills and spatters immediately with Xylene, R2K4. Clean tools immediately after use with Xylene, R2K4. Follow manufacturer's safety recommendations when using any solvent.

DISCLAIMER

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PERFORMANCE TIPS

Topcoating: Note minimum cure times at normal conditions before topcoating. Longer drying periods are required if primer cannot be water mist sprayed when humidity is low. Water misting may be required at humidities below 50%.
Occasionally topcoats will pinhole or delaminate from zinc-rich coatings. This is usually due to poor ambient conditions or faulty application of topcoats. This can be minimized by:

- Providing adequate ventilation and suitable application and substrate temperature.
- Avoid dry spray of topcoat.
- If pinholing develops, apply a mist coat of the topcoat, reduced up to 50%. Allow 10 minutes flash off and follow with a full coat.
- Applying a wet full coat, but at minimum film build, prior to applying a complete full coat.

Excessive film build, poor ventilation, and cool temperatures may cause solvent entrapment and premature coating failure.

Any salting on the zinc surface due to weathering exposure must be removed prior to topcoating.

An intermediate coat is recommended to provide uniform appearance of the topcoat.

Stripe coat all crevices, welds, and sharp angles to prevent early failure in these areas.

When using spray application, use a 50% overlap with each pass of the gun to avoid holidays, bare areas, and pinholes. If necessary, cross spray at a right angle.

Spreading rates are calculated on volume solids and do not include an application loss factor due to surface profile, roughness or porosity of the surface, skill and technique of the applicator, method of application, various surface irregularities, material lost during mixing, spillage, overthinning, climatic conditions, and excessive film build.

Excessive reduction of material can affect film build, appearance, and performance.

Do not mix previously catalyzed material with new.

Do not apply the material beyond recommended pot life.

In order to avoid blockage of spray equipment, clean equipment before use or before periods of extended downtime with Xylene, R2K4.

Keep pressure pot at level of applicator to avoid blocking of fluid line due to weight of material. Blow back coating in fluid line at intermittent shutdowns, but continue agitation at pressure pot.

Application above recommended film thickness may result in mud cracking.

Not recommended for severe acid or alkali exposures.

Oil base, alkyd, epoxy ester, and silicone alkyd topcoats are not recommended.

Polyurethane topcoats require a tie coat of catalyzed epoxy or Pro-Cryl Universal Primer.

Topcoats may be applied once 50 MEK double rubs are achieved. No zinc or only slight traces should be visible. Coin hardness test can also be used.

Cured films of inorganic zinc coatings contain no appreciable amounts of combustible materials. Both Fire and Smoke Indices would be expected to approach 0.

Refer to Product Information sheet for additional performance characteristics and properties.

SAFETY PRECAUTIONS

Refer to the MSDS sheet before use.

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WARRANTY

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ADHESIVE ANCHORING INSTALLATION INSTRUCTIONS

JUMP TO:

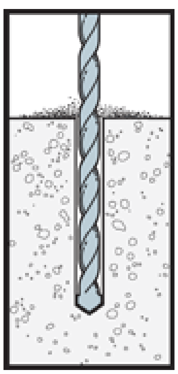
NOTE: Always check expiration date on product label. Do not use expired product.

WARNING: When drilling and cleaning hole use eye and lung protection. When installing adhesive use eye and skin protection.

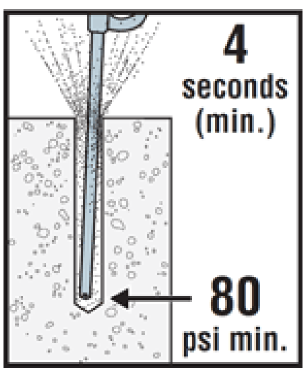
1. HOLE PREPARATION: Horizontal, Vertical and Overhead Applications

top

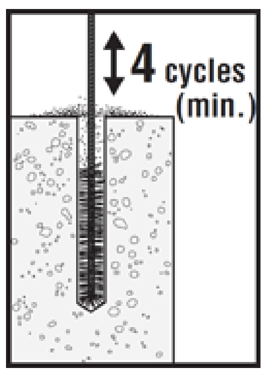
Notes:
Refer to Hole Cleaning Brushes for proper brush part number.



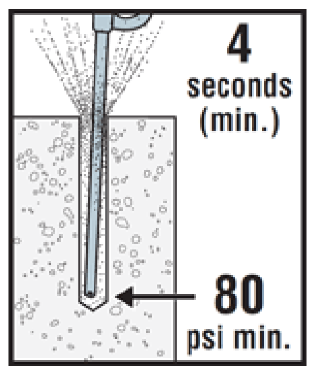
1. Drill –
Drill hole to specified diameter and depth.



2. Blow –
Remove dust from hole with oil-free compressed air for a minimum of 4 seconds. Compressed air nozzle **must** reach the bottom of the hole.



3. Brush –
Clean with a nylon brush for a minimum of 4 cycles. Brush should provide resistance to insertion. If no resistance is felt, the brush is worn and must be replaced.



4. Blow –
Remove dust from hole with oil-free compressed air for a minimum of 4 seconds. Compressed air nozzle must reach the bottom of the hole.

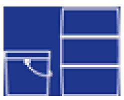
2. CARTRIDGE PREPARATION

top

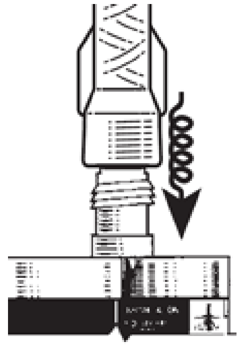
Notes:
Refer to Mixing Nozzles for proper mixing nozzle and Adhesive Dispensing Tools for dispensing tool part number.

1. Check –
Check expiration date on product label. **Do not use expired product.** Product is usable until end of printed expiration month.

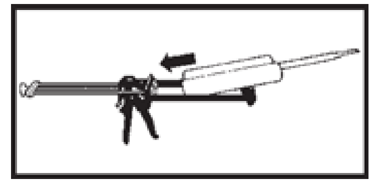
2. Open –
Open cartridge per package instructions.



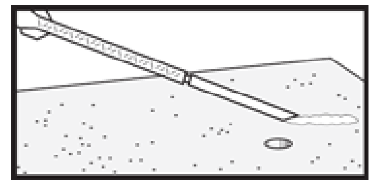
Note: For bulk dispensing, check pail or drum label for detailed mixing and preparation instructions.



3. Attach – Attach proper Simpson Strong-Tie® nozzle to cartridge. Do not modify nozzle.



4. Insert – Insert cartridge into dispensing tool.



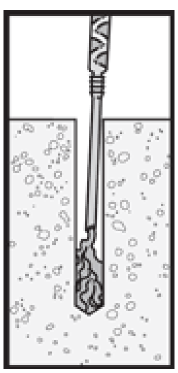
5. Dispense – Dispense adhesive to the side until properly mixed (uniform color).

3. FILLING THE HOLE: Vertical Anchorage

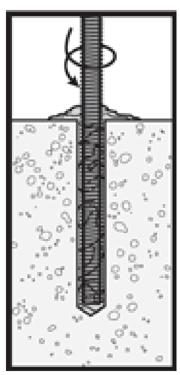
top ▲

Prepare the hole per instructions "Hole Preparation".
Note: Nozzle extensions may be needed for deep holes.

Dry and Damp Holes:

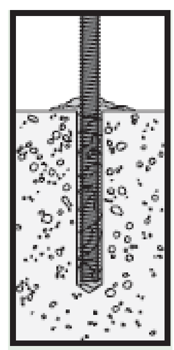


1. Fill –
Fill hole 1/2 - 2/3 full, starting from bottom of hole to prevent air pockets. Withdraw nozzle as hole fills up.



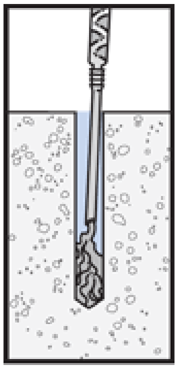
Threaded rod or rebar

2. Insert –
Insert clean, oil free anchor, turning slowly until the anchor contacts the bottom of the hole.

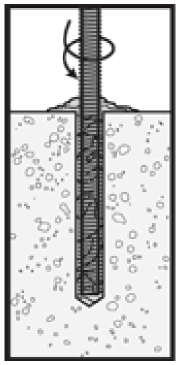


3. Do not disturb – Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

Water Filled Holes:

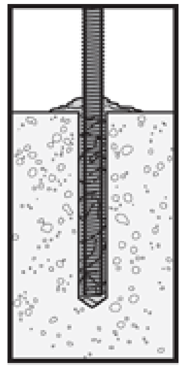


1. Fill – Fill hole completely full, starting from bottom of hole to prevent water pockets. Withdraw nozzle as hole fills up.



2. Insert – Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the hole.

Threaded rod or rebar

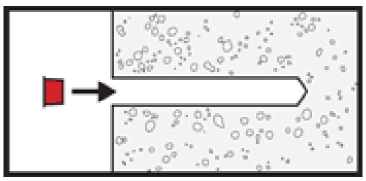


3. Do not disturb – Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

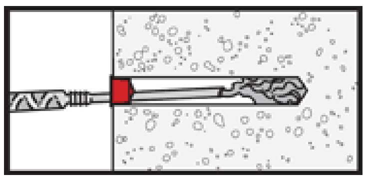
FILLING THE HOLE: Horizontal and Overhead Anchorage

top ▲

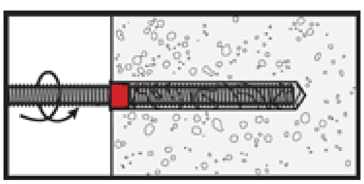
Prepare the hole per instructions "Hole Preparation".
Note: Nozzle extensions may be needed for deep holes.



1. Install – Install Simpson Strong-Tie® ARC adhesive retaining cap. Refer to Adhesive Retaning Caps for proper ARC size.

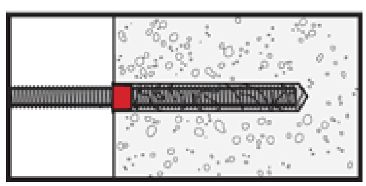


2. Fill – Fill hole 1/2 - 2/3 full, starting from bottom of hole to prevent air pockets. Withdraw nozzle as hole fills up.



Threaded rod or rebar

3. Insert – Insert clean, oil-free anchor, turning slowly until the anchor contacts the bottom of the hole.



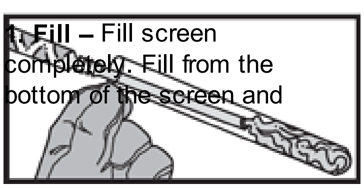
Threaded rod or rebar

4. Do not disturb – Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

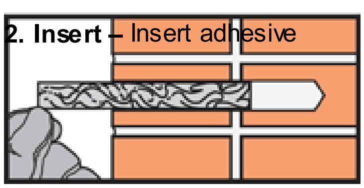
FILLING THE HOLE: When Anchoring with Screens: For AT, ET-HP, and SET Adhesives (except SET1.7KT)

top ▲

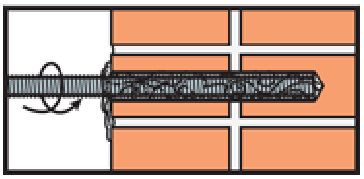
Prepare the hole per instructions "Hole Preparation".



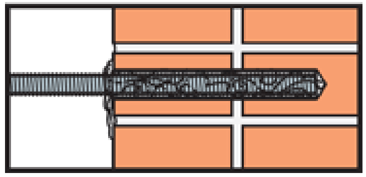
1. Fill – Fill screen completely. Fill from the bottom of the screen and withdraw the nozzle as the screen fills to prevent air pockets. (Opti-Mesh® screens: Close integral cap after filling.)



2. Insert – Insert adhesive filled screen into hole.



3. Insert – Insert clean, oil free anchor, turning slowly until the anchor contacts the bottom of the screen.

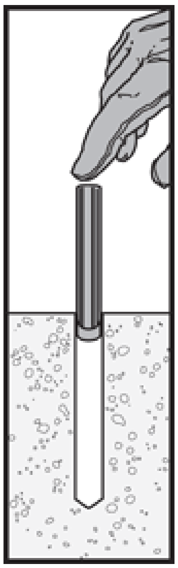


4. Do not disturb – Do not disturb anchor until fully cured. (See cure schedule for specific adhesive.)

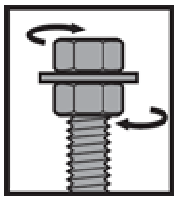
FILLING THE HOLE: VGC Vinylester Glass Capsule (Hammer Capsule)

top ▲

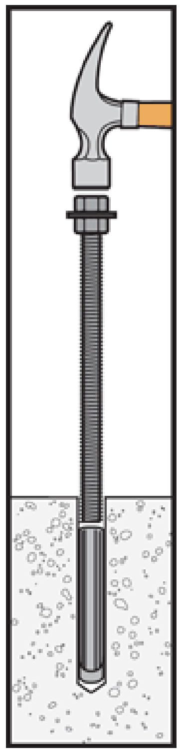
Prepare the hole per instructions "Hole Preparation".



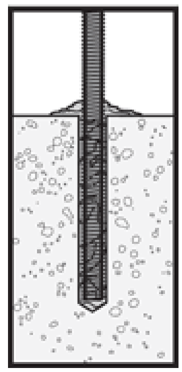
1. Insert – Insert the VGC capsule(s) to the bottom of the hole (either end first).



2. Install – Install double nut to protect thread.



3. Drive – Drive stud or rod to the bottom of the hole. Spinning of the stud or rod is not required.



4. Do not disturb– Do not disturb anchor until fully cured. (See cure schedule for VGC.) **VGC is not recommended for overhead applications.**

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>> Home > Products > Anchor Systems > Adhesives

SET-XP® High-Strength Anchoring Adhesive for Cracked and Uncracked Concrete

SET-XP® is a 1:1 two-component, high-solids, epoxy-based anchoring adhesive formulated for optimum performance in both cracked and uncracked concrete. SET-XP® adhesive has been rigorously tested in accordance with ICC-ES AC308 and 2009 IBC requirements and has proven to offer increased reliability in the most adverse conditions, including performance in cracked concrete under static and seismic loading. SET-XP® adhesive is teal in color in order to be identified as a high-performance adhesive for adverse conditions. Resin and hardener are dispensed and mixed simultaneously through the mixing nozzle. SET-XP® adhesive exceeds the ASTM C881 specification for Type I and Type IV, Grade 3, Class C epoxy.

CODE LISTED FOR CRACKED CONCRETE

SET-XP®

CODE LISTED
ICC-ES ESR-2508

- Read more about Cracked Concrete
- Free Software: Anchor Selector™ Software for ACI 318

GALLERY: roll over images below to see larger image

SET-XP® 10

SET-XP® 22

SET-XP® 56

EMN22i

EDT22S

USES

When SET-XP® adhesive is used with all threaded rod or rebar, the system can be used in tension and seismic zones where there is a risk of cracks occurring that pass through the anchor location. It is also suitable for uncracked concrete conditions.

CODE REPORTS

- **UPDATED** ICC-ES ESR-2508 (PDF) (For cracked and uncracked concrete)
- **UPDATED** City of Los Angeles RR25744 (PDF) (For cracked and uncracked concrete)
- Florida FL 11506.5
- NSF/ANSI Standard 61 (216in^2/1000 gal) (PDF)

LINKS:

- Supplemental Topics for Adhesive Anchors
- Estimating Guide
- Limited Warranty Information
- Tension and Shear Data
- Load Adjustment Factors
- Documents:
  - Anchor Catalog section (PDF)
  - **NEW** Product Submittal Generator
  - Material Safety Data Sheet: SET-XP (PDF)
  - Material Safety Data Sheet: SET-XP *en Español* (PDF)
  - Material Safety Data Sheet: SET-XP *en Français* (PDF)
- Free Software:

The load tables list values based upon results from the most recent testing and may not reflect those in current code reports. Where code jurisdictions apply, consult the current reports for applicable load values.

APPLICATION

Surfaces to receive epoxy must be clean. The base-material temperature must be 50º F or above at the time of installation. For best results, material should be 70–80º F at the time of application. Cartridges should not be immersed in water to facilitate warming. To warm cold material, the cartridges should be stored in a warm, uniformly-heated area or storage container for a sufficient time to allow epoxy to warm completely. Mixed material in nozzle can harden in 5–7 minutes at a temperature of 40º F or above.

TEST CRITERIA

Anchors installed with SET-XP® adhesive have been tested in accordance with ICC-ES's Acceptance Criteria for Post-Installed *Adhesive Anchors in Masonry Elements (AC58)* and *Adhesive Anchors in Concrete Elements (AC308)* for the following:

- Seismic and wind loading in cracked and uncracked concrete and uncracked masonry
- Static tension and shear loading
- Horizontal and overhead installations
- Long-term creep at elevated temperatures
- Static loading at elevated temperatures
- Damp holes
- Freeze-thaw conditions
- Critical and minimum edge distance and spacing

PROPERTY	TEST METHOD	RESULTS
Consistency	ASTM C881	Passed, non-sag
Glass transition temperature	ASTM E1356	155°F (68° C)
Bond strength (moist cure)	ASTM C882	3,742 psi at 2 days
Water absorption	ASTM D570	0.10%
Compressive yield strength	ASTM D695	14,830 psi
Compressive modulus	ASTM D695	644,000 psi
Gel time	ASTM C881	49 minutes

Cure Schedule

Base Material Temperature		Gel Time (mins.)	Cure Time (hrs.)
°F	°C		
50	10	75	72
60	16	60	48
70	21	45	24
90	32	35	24
110	43	20	24

For w ater-saturated concrete, the cure times are doubled.

- Anchor Selector™ Software for ACI 318

ACCESSORIES

- Dispensing Tools
- Mixing Nozzles
- Hole Cleaning Brushes

SUGGESTED SPECIFICATION

Anchoring adhesive shall be a two-component high-solids, epoxy-based system supplied in manufacturer's standard cartridge and dispensed through a staticmixing nozzle supplied by the manufacturer. The adhesive anchor shall have been tested and qualified for performance in cracked and uncracked concrete per ICC-ES AC308. Adhesive shall be SET-XP® adhesive from Simpson Strong-Tie, Pleasanton, CA. Anchors shall be installed per Simpson Strong-Tie instructions for SET-XP epoxy adhesive.

DESIGN EXAMPLE

See Traditional ASD and ICC-ES AC308 example calculations.

INSTALLATION

IMPORTANT For installation instructions, click here.

SHELF LIFE

24 months from date of manufacture in unopened sideby-side cartridge.

STORAGE CONDITIONS

For best results, store between 45–90° F. To store partially used cartridges, leave hardened nozzle in place. To re-use, attach new nozzle.

COLOR

Resin – white, hardener – black-green. When properly mixed, SET-XP adhesive will be a uniform teal color.

CLEAN UP

Uncured material – Wipe up with cotton cloths. If desired, scrub area with abrasive, waterbased cleaner and flush with water. If approved, solvents such as ketones (MEK, acetone, etc.), lacquer thinner or adhesive remover can be used. DO NOT USE SOLVENTS TO CLEAN ADHESIVE FROM SKIN. Take appropriate precautions when handling flammable solvents. Solvents may damage surfaces to which they are applied. Cured Material – chip or grind off surface.

CHEMICAL RESISTANCE

Very good to excellent against distilled water, in-organic acids and alkalis. Fair to good against organic acids and alkalis, and many organic solvents. Poor against ketones. For more detailed information, contact Simpson Strong-Tie.

SET-XP Cartridge System

Model No.	Capacity ounces (cubic inches)	Cartridge Type	Carton Quantity	Dispensing tool(s)	Mixing Nozzle
SET-XP10	8.5 (16.2)	single	12	CDT10S	EMN22i
SET-XP22	22 (39.7)	side-by-side	10	EDT22S EDTA22P EDT22CKT	
SET-XP56	56 (101.1)	side-by-side	6	EDTA56P	

1. Cartridge estimation guides are available.
2. Detailed information on dispensing tools, mixing nozzles and other adhesive accessories is available.
3. Use only appropriate Simpson Strong-Tie mixing nozzle in accordance with Simpson Strong-Tie instructions. Modification or improper use of mixing nozzle may impair epoxy performance.

SET-XP® Epoxy Anchor Installation Information and Additional Data for Threaded Rod and Rebar in Normal-Weight Concrete[1]

Characteristic		Symbol	Units	Nominal Anchor Diameter (in.) / Rebar Size						
				⅜ / #3	½ / #4	⅝ / #5	¾ / #6	⅞ / #7	1 / #8	1¼ / #10
Installation Information										
Drill Bit Diameter		d_{hole}	in.	½	⅝	¾	⅞	1	1⅛	1⅜
Maximum Tightening Torque		T_{inst}	ft-lb	10	20	30	45	60	80	125
Permitted Embedment Depth Range[2]	Minimum	h_{ef}	in.	2⅜	2¾	3⅛	3½	3¾	4	5
	Maximum	h_{ef}	in.	7½	10	12½	15	17½	20	25
Minimum Concrete Thickness		h_{min}	in.	$h_{ef} + 5d_0$						
Critical Edge Distance		c_{ac}	in.	$3 \times h_{ef}$						
Minimum Edge Distance		c_{min}	in.	1¾						2¾
Minimum Anchor Spacing		s_{min}	in.	3						6

1. The information presented in this table is to be used in conjunction with the design criteria of ICC-ES AC308.
2. Minimum and maximum embedment depths are are listed in accordance with ICC-ES AC308 requirements.

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